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MYXOPHYCEAE OF EASTERN CALIFORNIA AND WESTERN NEVADA

BY

FRANCIS DROUET

CURATOR OF CRYPTOGAMIC BOTANY

BOTANICAL SERIES

FIELD MUSEUM OF NATURAL HISTORY

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NOVEMBER 20, 1943

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UNIVERSITY OF ILLINOIS
URBANA

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MYXOPHYCEAE OF EASTERN CALIFORNIA AND WESTERN NEVADA

FRANCIS DROUET

East, northeast, and southeast of the Sierra Nevada lies a rough, arid, scantily populated region extending to the Wasatch and Rocky mountains. Its western half includes all of western Nevada and that portion of California northeast and east of the Sierra Nevada in Modoc, Lassen, Sierra, Placer, Eldorado, Alpine, Mono, and Inyo counties and east of the San Gabriel and San Jacinto mountains in San Bernardino, Riverside, and Imperial counties. Hot and cold springs are abundant, especially along the eastern escarpment of the Sierra Nevada. The valleys and depressions are largely closed drainage-basins which contain salt lakes, dry salt flats, and playas, some below sea-level. The rainfall is slight, ranging from 3 to 15 inches a year in various parts of the area; water from this source persists throughout the year in bodies of water in some of the depressions. Small streams originating in the springs and melting snows in the high mountains also flow into the region. Freshwater lakes fed by springs or mountain streams are few and widely scattered.

In a region with so meager a supply of water it is to be expected that the algal flora contains many species of specialized habitats. Except in the immediate vicinity of streams, springs, and freshwater lakes, the vascular plants, mosses, and lichens do not form a continuous ground-cover; this is especially evident in the deserts of the south. Here the most abundant plant-growths are the crusts of algae which cover the soil. The hot springs and the streams which they feed are the habitats of totally different species of algae. The salt playas and alkaline lakes contain other species, while the cold springs and freshwater streams and lakes have still others.

Until recent years only occasional specimens of algae have been picked up in this region by botanical collectors. A Mrs. Partz of Benton, California, sent specimens from the hot springs there to H. C. Wood in August 1866. F. V. Coville and F. Funston collected a few specimens on the Death valley expedition of the United States Department of Agriculture in 1891. S. B. Parish preserved a number of algae during his exploration of southern California in 1891–1895. W. A. Setchell collected in the hot springs of the San Bernardino

mountains in 1896; he was followed in the same localities by H. E. Parks in 1929 and by N. L. Gardner in 1930. Random specimens have been taken since 1900 by Annetta Carter, V. Duran, David Griffiths, J. and H. W. Grinnell, H. M. Hall and E. B. Babcock, R. M. Holman and Lee Bonar, G. Evelyn Hutchinson, O. L. Inman, P. A. Munz, and Guy Wilkenson. George J. Hollenberg has made many collections in southern California from 1934 until the present date. M. J. Groesbeck took some four hundred collections at frequent intervals during 1940 and 1941 from the hot springs of Inyo and Mono counties, California, and Washoe county, Nevada; additional material was collected in Death valley and other localities in the region. On the Field Museum cryptogamic expedition to California in 1941, Francis Drouet and Donald Richards collected in the vicinity of Alturas in northeastern California, and Francis Drouet and J. Francis Macbride in the deserts of southern California.

I wish to thank particularly M. J. Groesbeck, M. D., of Porterville, California, for the opportunity to present here so complete a treatment of the myxophycean flora of the region under consideration. Her large series of collections from many of the groups of hot springs and from other localities, accumulated with considerable personal expenditure of money and time, are excellently prepared and were gathered in sufficient numbers to give an adequate picture of the components of the flora in these places. She has been most generous and solicitous in furnishing supplementary information wherever needed. I am indebted to the late Professor W. A. Setchell and to the members of the Staff of the Herbarium of the University of California for their hospitality during my visit there in 1941 and for making available to me the numerous collections from the region in the general herbarium and in that of the late Professor Nathaniel L. Gardner. Mr. Donald Richards and Mr. J. Francis Macbride of Field Museum share the responsibility for the very profitable collecting of algae in California during the expedition of 1941. Mr. William A. Daily, Mr. J. C. Strickland, and Mr. Richards have offered many welcome suggestions concerning the manuscript. Miss Rosalie Weikert and Dr. Ruth Patrick gave much appreciated assistance with certain of the bibliographical details.

The specimens cited here are all on file in the Cryptogamic Herbarium of Field Museum (and for the most part represented by duplicates in the Herbarium of the University of California), except

where indicated by the following abbreviations as occurring in other herbaria: C, Herbarium of the University of California; D, Herbarium of Francis Drouet; F, Farlow Herbarium of Harvard University; N, New York Botanical Garden. Still other herbaria are referred to without abbreviation. Where precision has seemed desirable, the Cryptogamic Herbarium of Field Museum is designated by the abbreviation FM.

Chroococcaceae

APHANOCAPSA GREVILLEI (Berk.) Rabenh. Fl. Eur. Alg. 2: 50. 1864; Daily Amer. Midl. Nat. 27: 640, f. 5. 1942. *Palmella Grevillei* Berk. Glean. Br. Alg. 16. 1833. *Coccochloris Grevillei* Hass. Hist. Brit. Freshw. Alg. 1: 318. 1845. *Anacystis Grevillei* Kütz. Sp. Alg. 209. 1849.—In shallow fresh water and on wet objects. Specimens seen, CALIFORNIA: Inyo county: in cold stream 1 ft. away from outlet of Keough hot springs, *Groesbeck 230*, Nov. 1940; on rock subject to steam and spray, the Geysers, *Groesbeck 140*, Sept. 1940.

GLOEOCAPSA VIOLACEA Kütz.[1] Tab. Phyc. 1: 25. 1847 (not Rabenh. Fl. Eur. Alg. 2: 41. 1865). *G. nigrescens* Näg. in Rabenh. Alg. 35 & 36: 629. 1857; Daily Amer. Midl. Nat. 27: 646, f. 13, 14, 37. 1942. *G. lignicola* Rabenh. Fl. Eur. Alg. 2: 41. 1865.—On objects kept moist during long periods of the year, seldom found submersed. Specimens seen, NEVADA: inside a tank of cold water, Steamboat, *Groesbeck 190, 375*, Sept. 1940, Apr. 1941. CALIFORNIA: Mono county: board on ground, Bridgeport, *Groesbeck 331*, Apr. 1941; stone in overflow of hot artesian well, north side of Mono lake, *Groesbeck 129*, Sept. 1940. Inyo county: about vent actively spitting drops of boiling water, Hot creek geysers, *Groesbeck 418a*, July 1941; first spring south of Triangle spring, Death valley, *Grinnell 7625*, Oct. 1933. San Bernardino county: on the trunk of a palm tree, Needles, *Drouet & Macbride 4593*, Oct. 1941; Waterman hot springs, *Setchell 1554*, Dec. 1896.

[1] In taking up this name we note that Rabenhorst in Fl. Eur. Alg. 2: 41 (1865) proposed *G. lignicola* to supplant Kützing's *G. violacea* (as represented by specimens distributed in Rabenh. Alg. 2031, FRANCE: sur l'écorce des peupliers tremble et ypréau, env. de Paris et de la Falaise, *A. de Brébisson* [FM, N]) in order to make the new combination *G. violacea* (Corda) Rabenh. based upon *Protococcus violaceus* Corda. We have no choice here but to employ the earlier homonym. Original specimens of *G. nigrescens* Näg., SWITZERLAND: an einem Brunnen bei Küssnacht unweit Zürich, *Wartmann* (Rabenh. Alg. 629, FM), contain plants similar to those of *G. violacea* Kütz.—F. DROUET AND WILLIAM A. DAILY.

GLOEOCAPSA MAGMA (Bréb.) Kütz.[1] Tab. Phyc. 1: 17. 1847; Daily Amer. Midl. Nat. 27: 645, f. 10–12, 17. 1942. *Protococcus magma* Bréb. in Bréb. & God. Alg. Falaise 40. 1845. *Pleurococcus magma* Menegh. Mem. R. Accad. Sci. Torino 2 ser. 5: 43. 1848. *Monocapsa stegophila* Itzigs. in Rabenh. Alg. 27 & 28: 263. 1853. *Gloeocapsa stegophila* Rabenh. Krypt.-Fl. Sachs. 1: 72. 1863. *G. Itzigsohnii* Born. apud Zopf Spaltpfl. 69, Taf. 7, f. 6–9. 1882. *Entophysalis magnoliae* Farl. Mar. Alg. New Engl. 29. 1891. *Gloeocapsa magma* var. *Itzigsohnii* Hansg. Prodr. 2: 147. 1892. *Chroococcus Simmeri* Schmidle Allgem. Bot. Zeitschr. 1898: 158. 1898. *Gloeocapsa multisphaerica* Gardn. Univ. Calif. Publ. Bot. 14: 1. 1927.—On rocks and trees, apparently not commonly seen in western North America. One collection, CALIFORNIA: San Bernardino county: on quartz outcrops in rocky rolling ground near Mountain Spring camp northeast of Essex, *Drouet & Macbride 4609*, Oct. 1941.

CHROOCOCCUS RUFESCENS (Kütz.) Näg.[2] Gatt. einz. Alg. 46. 1848; Daily Amer. Midl. Nat. 27: 642, f. 9. 1942. *Protococcus rufescens* Kütz. Tab. Phyc. 1: 9. 1846. *Pleurococcus rufescens* Bréb. in Kütz. pro synon., loc. cit. 1846. *Chroococcus helveticus* Näg. Gatt. einz. Alg. 46. 1848. *C. virescens* Hantzsch in Rabenh. Alg. 33 & 34: 1332. 1862. *C. granulosus* Zell. Hedwigia 1873: 169. 1873. *C. minutus* var. *virescens* Hansg. Prodr. 2: 162. 1892. *Gloeocapsa*

[1] A number of specimens labeled *Protococcus magma* Bréb. from Falaise, Calvados, and presumably originating in Brébisson's herbarium are present in the Farlow Herbarium, the cryptogamic herbarium of Field Museum, and the herbarium of F. Drouet. Similar to these in all morphological details are the following specimens which are the bases of other names cited here as synonyms of *Gloeocapsa magma*. BRANDENBURG: Neudamm, *Itzigsohn*, Dec. 1852 (isotype of *Monocapsa stegophila*, Rabenh. Alg. 263, FM). CARINTHIA: auf alten Holz, am Knoten, *H. Simmer*, Aug. 1897 (isotype of *Chroococcus Simmeri*, N). FRANCE: sur l'écorce de Populus alba, Versailles, *E. Bornet*, 1850 (isotype? of *Gloeocapsa Itzigsohnii*, F). MASSACHUSETTS: Magnolia, *W. G. Farlow*, Aug. 1871 (TYPE of *Entophysalis magnoliae*, F). CHINA: on wet rock, Kushan near Foochow, *H. H. Chung A363c*, Aug. 1926 (TYPE of *Gloeocapsa multisphaerica*, F).—F. DROUET AND W. A. DAILY.

[2] We base this name, the type species of *Chroococcus* Näg., upon the specimen in Rabenh. Alg. 2034 (FM): CALVADOS: couches épaisses sur les mousses inondées dans une cascade dans les Falaises près d'Arromanches, *A. de Brébisson*, labeled *Protococcus rufescens* Kütz., and upon another (FM) from Arromanches labeled *Pleurococcus rufescens* by Brébisson. These and the following original specimens, the bases of other names cited here as synonyms, appear to represent a single species. GERMANY: ges. in Aug. 1860, cultivirt bis Mai 1862, *C. A. Hantzsch* (isotype of *Chroococcus virescens* in Rabenh. Alg. 1332, N). SWITZERLAND: Erlenbacher Tobel an Felsen, Zürich, *Nägeli*, Sept. 1848 (specimen of *C. helveticus* by the author, FM). WISCONSIN: on boards, Osceola, *J. E. Tilden*, Sept. 1897 (isotype of *Gloeocapsa calcarea* in Tild. Amer. Alg. 299, FM). BURMA: auf bloser Erde, Thabyaegon, *S. Kurz* (isotype of *Chroococcus granulosus* in Rabenh. Alg. 2332, N).—F. DROUET AND W. A. DAILY.

calcarea Tild. Amer. Alg. 3: 299. 1898.—On wet objects and in shallow fresh or brackish water, well represented in the collections from springs at lower temperatures, NEVADA: Washoe county: in a cold pool, Steamboat springs, *Groesbeck 293*, Nov. 1940. CALIFORNIA: Mono county: cold and warm pools and springs at the travertine quarry, Bridgeport, *Groesbeck 42, 101, 257, 342, 469*, 1940–41; under ice in pool in side of cliff, Hot creek geysers, *Groesbeck 206*, Nov. 1940. Inyo county: with *Aphanocapsa Grevillei* on rock, the Geysers, *Groesbeck 140*, Sept. 1940; culture from Bad Water, Death valley, *Holman & Bonar 7799*, Apr. 1933; cold alkaline stream, Gnome's Workshop, Death valley, *Groesbeck 295*, Jan. 1941; Nevares spring near Cow creek, Death valley, *Munz 2280.5*, Apr. 1937.

CHROOCOCCUS TURGIDUS (Kütz.) Näg. Gatt. einz. Alg. 46. 1848. *Protococcus turgidus* Kütz. Tab. Phyc. 1: 5. 1846. *Pleurococcus turgidus* Trev. Sagg. Monogr. Alg. Coccot. 34. 1848. *Chroococcus turgidus* var. *rufescens* Wartm. in Rabenh. Alg. 63 & 64: 631. 1857. *C. thermophilus* Wood Amer. Journ. Sci. ser. 2, 46: 34. 1868.—In shallow fresh or brackish, cold or warm water, often seen mixed with other algae on wet objects. The type collection of *C. thermophilus* Wood contains plants similar to those of other collections listed here. CALIFORNIA: Mono county: in outlet of a hot spring and in a large warm pool, travertine quarry near Bridgeport, *Groesbeck 46, 101*, Apr., June 1940; hot spring, Benton, *Mrs. Partz*, Aug. 1866 (TYPE of *C. thermophilus* in Acad. Nat. Sci. Phila.; isotype, FM). Inyo county: tepid stagnant water, Keough hot springs, *Groesbeck 399*, July 1941, idem with *Lyngbya aestuarii* in a cold stream, *230*, Nov. 1940; first spring south of Triangle spring, Death valley, *Grinnell 7626*, Oct. 1933; in tepid spring, Furnace creek wash, Death valley, *Groesbeck 298*, Jan. 1941; cold alkaline spring, Gnome's Workshop, Death valley, *Groesbeck 215*, Oct. 1940, idem with *C. rufescens, 295*, Jan. 1941. San Bernardino county: Waterman hot springs, *Setchell 1554a*, Dec. 1896.

PLEUROCAPSA VARIA (A. Br.) Drouet & Daily in Daily Amer. Midl. Nat. 27: 644, f. 36, 39. 1942. *Chroococcus varius* A. Br. in Rabenh. Alg. 246–248: 2451. 1876; in Wittr. & Nordst. Alg. exs. 12: 600. 1883; Hansg. Prodr. 2: 164. 1892. *Chroococcus cohaerens* Näg. in Rabenh. Alg. 45 & 46: 446. 1855 [not Näg. Gatt. einz. Alg. 46. 1848]. *C. decolorans* Mig. Crypt. Germ. Austr. & Helv. exs. 26 & 27 (Algen): 83. 1906.—On rocks and wood in wet places, often in shallow running water. CALIFORNIA: Mono county: in outflow

of pool, travertine quarry at Bridgeport, *Groesbeck 256*, Nov. 1940; warm pool in weeds by Hot creek, *Groesbeck 202*, Nov. 1940.

ANACYSTIS MARGINATA Menegh. Consp. Fl. Eugan. 6. 1837; Daily Amer. Midl. Nat. 27: 649, f. 28. 1942. *Palmella marginata* Kütz. Phyc. gener. 172. 1843. *Microcystis marginata* Kütz. Tab. Phyc. 1: 6. 1846. *Palmella Castagnei* Kütz.[1] ibid. 1: 1846. *Oncobyrsa Castagnei* Bréb. in Kütz. pro synon., loc. cit. 1846. *Cagniardia Castagnei* Trev. Sagg. Monogr. Alg. Coccot. 51. 1848. *Aphanocapsa Castagnei* Rabenh. Fl. Eur. Alg. 2: 50. 1865. *Aphanothece Castagnei* Rabenh. ibid. 2: 64. 1865. *Polycystis marginata* Richt. Hedwigia 1885: 20. 1885. *Aphanothece conferta* Richt. in Hauck & Richt. Phyk. univ. 10: 487. 1892.—Subaerial and in shallow fresh water, both hot and cold. Specimens seen, CALIFORNIA: on stems in a cold pool, travertine quarry near Bridgeport, *Groesbeck 42, 265*, Apr. and Nov. 1940; in a small hot spring and around a vent actively spitting drops of boiling water, Hot creek geysers, *Groesbeck 61, 418*, June 1940, July 1941; Benton hot springs, *Duran 7797*, Apr. 1935.

ANACYSTIS RUPESTRIS (Lyngb.) Drouet & Daily[2] in Daily Amer. Midl. Nat. 27: 650, f. 19, 26. 1942. *Palmella rupestris* Lyngb. Tent. Hydrophyt. Dan. 207. 1819. *Microcystis rupestris* Kütz. Linnaea 8: 374. 1833. *Microhaloa rupestris* Kütz. Phyc. gener. 169. 1843. *Gloeocapsa tepidariorum* A. Br. in Rabenh. Alg. 23 & 24: 221. 1852. *Gloeothece distans* Stizenb. in Rabenh. Alg. 97 & 98: 971. 1860. *Aphanothece Naegelii* Wartm. in Rabenh. Alg. 109 & 110: 1093. 1861. *Gloeothece tepidariorum* Lagerh. Öfv. Kgl. Vet.-Akad. Förh.

[1] Original specimens of *Palmella Castagnei*, FRANCE: Aix, Provence, ex herb. Lenormand (isotype?, FM); dans l'étang de la Valduc, *Castagne* (Desmaz. Pl. Crypt. Fr. 4955, N), are similar in structure to those of *Anacystis marginata* Menegh. The same is true of original material of *Aphanothece conferta* Richt., SAXONY: Oschatz, in einem Gewächshause in Kalkwänden, *E. May*, Feb. 1892 (Hauck & Richt. Phyk, univ. 487, F).—F. DROUET AND W. A. DAILY.

[2] Not having seen the original specimens of *Palmella rupestris* Lyngb., we have followed the interpretation of Ed. Bornet, as shown in specimens labeled by him in the Farlow Herbarium. Similar to these are the following specimens, the bases for other names listed here as synonyms: BRANDENBURG: in Warmhaus des Universitätgarten, Berlin, *A. Braun*, Oct. 1875 (original material of *Gloeothece decipiens* in Rabenh. Alg. 2456, FM, N), idem Dec. 1875 (isotype of *Aphanocapsa biformis* in Rabenh. Alg. 2453b, F), idem Berliner bot. Garten, Apr. 1875 (original material of *Gloeothece decipiens* in Rabenh. Alg. 2456b, FM, N); im Warmhaus des Geheimen Oberhofbuchdruckers Decker, Berlin, *A. Braun*, Juli & Okt. 1852 (isotype of *Gloeocapsa tepidariorum* in Rabenh. Alg. 221, FM). BADEN: Constanz in Torftümpeln, *E. Stizenberger*, Apr. 1860 (isotype of *Gleoothece distans* in Rabenh. Alg. 971, FM). SWITZERLAND: Zweibrücker-Tabel bei St. Gallen, *Wartmann*, Juli 1860 (isotype of *Aphanothece Naegelii* in Rabenh. Alg. 1093, FM, N). PUERTO RICO: on a water-pipe near a stream, Maricao, *N. Wille 1147*, Feb. 1915 (isotype of *Aphanothece conferta* var. *brevis*, D). CHINA: Fulung hot springs, Fukien province, *H. H. Chung A439*, Sept. 1926 (isotype of *Aphanothece gelatinosa*, D).—F. DROUET AND W. A. DAILY.

Stockholm 40 (2): 44. 1883. *Gloeothece decipiens* A. Br. apud Richt. in Wittr. & Nordst. Alg. exs. 13: 594. 1883. *Aphanocapsa biformis* A. Br. apud Richt. in Wittr. & Nordst. ibid. 12: 600. 1883. *Gloeothece rupestris* Born. pro synon. Mém. Soc. Nat. Cherbourg 28: 177. 1892; Hansg. Prodr. 2: 136. 1892. *G. rupestris* var. *tepidariorum* Hansg. loc. cit. 1892. *Aphanothece conferta* var. *brevis* Gardn. Mem. New York Bot. Gard. 7: 4. 1927. *A. gelatinosa* Gardn. Univ. Calif. Publ. Bot. 14: 2. 1927.—A cosmopolitan species, chiefly growing on moist soil and rocks, often found in shallow water. Specimens seen, CALIFORNIA: Inyo county: Nevares spring near Cow creek, Death valley, *Hollenberg 2279*, Apr. 1937 (D). San Bernardino county: Arrowhead hot springs, *Setchell 1539, 1545*, Dec. 1896, *Gardner 17, 18*, May 1930. Riverside county: in crevice of dripping rocks, Palm canyon near Palm Springs, *Hollenberg 1632*, Mar. 1935 (D).

ANACYSTIS PENIOCYSTIS (Kütz.) Drouet & Daily in Daily Amer. Midl. Nat. 27: 651. f. 29, 35, 38. 1942. *Gloeocapsa Peniocystis* Kütz.[1] Tab. Phyc. 1: 25. 1847. *Peniocystis purpurea* Bréb. in Kütz. pro synon. loc. cit. 1847. *Gloeocapsa purpurea* Kütz. ibid. 1: 18. 1847.—In shallow warm or cold fresh water, or with other algae on wet rocks and wood. As Daily (op. cit.) has pointed out, this alga passes under the name *Gloeothece linearis* Näg. in recent literature. Specimens seen, NEVADA: Washoe county: small basin in calcareous deposit and small tepid pool, Steamboat, *Groesbeck 114, 192*, June, Sept. 1940. CALIFORNIA: Mono county: on stems in a large cold spring and on side of a large cold pool at the travertine quarry near Bridgeport, *Groesbeck 175, 472*, Sept. 1940, July 1941; with *Spirulina labyrinthiformis* in a cold pool, Hot creek geysers, *Groesbeck 417*, July 1941. San Bernardino county: in a hot water creek, Arrowhead hot springs, *Parks 3250*, Dec. 1929.

COELOSPHAERIUM KUETZINGIANUM Näg. Gatt. einz. Alg. 54, Tab. 1C. 1848; Daily Amer. Midl. Nat. 27: 654, f. 23. 1942. *C.*

[1] For authentic material of *Gloeocapsa Peniocystis* Kütz. we have accepted here a specimen in the cryptogamic herbarium of Field Museum from Arromanches, Calvados, labeled *Peniocystis purpurea* by A. de Brébisson. Although Kützing (loc. cit.) says that the type comes from Falaise he records elsewhere in the same publication the occurrence of *G. Peniocystis* with *G. purpurea* from Arromanches. Moreover, as can be seen in the first sentence in the footnote under *Chroococcus rufescens* above, there is no assurance that Brébisson's "Falaise" refers in every instance to the town of that name or to swamps in the vicinity of Arromanches. Similar material from Arromanches by Brébisson is distributed under the name *G. purpurea* in Rabenh. Alg. 1596 (FM, N). The chroococcaceous forms in these two collections described by Kützing as *G. Peniocystis* and *G. purpurea* are interpreted here as growth-forms of a single species.—F. DROUET AND W. A. DAILY.

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Naegelianum Ung.[1] Denkschr. k. Akad. Wiss. math.-naturw. Kl. Wien 7: 195, f. 8. 1854. *C. Wichurae* Hilse in Rabenh. Alg. 153 & 154: 1523. 1863. *Hydroepicoccum genuense* de Not. Hedwigia 1869: 86. 1869. *Coelosphaerium genuense* de Not. in Ard. & Straff. Enum. Alg. Lig. 61. 1877.—Planktonic in bodies of fresh water and developing as waterbloom. Specimens seen, CALIFORNIA: San Bernardino county; Big Bear lake, *Hollenberg 469*, Aug. 1934 (D), idem *1624* (FM).

GOMPHOSPHAERIA APONINA Kütz. Alg. exs. Dec. 16: 151. 1836; Daily Amer. Midl. Nat. 27: 665, f. 20, 21. 1942. *G. aponina* var. *cordiformis* Wolle in Wittr. & Nordst. Alg. exs. 10: 498. 1882.—In shallow fresh and brackish water, often found mixed with other algae on wet rocks etc. Specimens seen, CALIFORNIA: Mono county: in a large warm pool and in the cold part of the run-off from a very hot spring, travertine quarry near Bridgeport, *Groesbeck 101, 161*, June, Sept. 1940; with *Phormidium laminosum* in a hot pool, Hot creek geysers, *Groesbeck 407*, July 1941. Inyo county: alkaline pool, Bad Water, Death valley, *Holman & Bonar 7213*, Apr. 1933, *Groesbeck 1, 217, 303*, Feb., Oct. 1940, Jan. 1941.

Chamaesiphonaceae

DERMOCARPA HOLLENBERGII Drouet, Field Mus. Bot. Ser. 20: 129. 1942.—One specimen, the type, CALIFORNIA: San Bernardino county: attached to Rhizoclonium in small pond at Old Woman springs, Mojave desert, *Hollenberg 2084*, May 1937 (D).

[1] Limnological literature is crowded with speculations about what the names *C. Kuetzingianum* Näg. and *C. Naegelianum* Ung. refer to. Having had access to the original specimens of neither, we are not prepared to offer material evidence to support a contention that Nägeli and Unger were describing the same species. But when we compare the original descriptions and figures, we find no mention of the presence or absence of pseudovacuoles (the word was not introduced until some decades later) nor illustrations of them; also we find no reference to differences in shapes of the protoplasts. It has been called to our attention that upon the basis of just these differences the two authors of important recent works on freshwater algae, Geitler in Rabenh. Krypt.-Fl. 14: 248–253 (1931) and Smith in Freshw. Alg. U. S. 66 (1933), have separated the two species; we find no evidence that the authors have examined the original specimens either. *C. Kuetzingianum*, according to both Geitler and Smith, is a plant with spherical protoplasts which contain no pseudovacuoles; the plants never develop *en masse* as heavy waterblooms but inhabit shallow water and are carried only fortuitously into the plankton. Students who employ these two publications apparently have difficulty in identifying plants with this description. Specimens of the coelosphaeroid growth-form of *Polycystis aeruginosa* Kütz. (with the pseudovacuoles lost before preservation or after long standing in formalin) and of *Coelosphaerium Collinsii* Drouet & Daily and *Gomphosphaeria lacustris* Chod. (both of which have elongated protoplasts) are popular for designation as *Coelosphaerium Kuetzingianum* in recent limnological literature. Specimens of the planktonic *C. Kuetzingianum* as described by Daily (loc. cit.) are the ones most frequently determined as *C. Naegelianum* according to Geitler's and Smith's keys and descriptions. In Nägeli's

DERMOCARPA GARDNERIANA Drouet ibid. 20: 128. 1942.—On rocks in shallow running water. One specimen, NEVADA: Washoe county: with *Calothrix parietina* in a cold stream, Steanboat, *Groesbeck 447*, July 1941.

DERMOCARPA SETCHELLII Drouet ibid. 20: 129. 1942.—Known only from the type collection, CALIFORNIA: San Bernardino county: Harlem hot springs, *Setchell 1560*, Dec. 1896.

CHAMAESIPHON POLONICUS (Rostaf.) Hansg. Prodr. Algenfl. Böhmen 2: 123. 1892. *Sphaerogonium polonicum* Rostaf. Rozpr. Akad. umiej. Kraków. 10: 299. 1883.—On stones and wood in streams, fountains, etc. One collection, NEVADA: Washoe county: in a drinking fountain in the park, Reno, *Drouet & Richards 4112*, Sept. 1941.

Stigonemataceae

FISCHERELLA AMBIGUA (B. & F.) Gom. Journ. de Bot. 9: 52. 1895. *Scytonema ambiguum* Kütz. ex B. & F. Ann. Sci. nat. VII Bot. 5: 100. 1887. *S. badium* Wolle ex B. & F. ibid. 5: 111. 1887. *Phormidium interruptum* var. *rigidum* Gardn. Mem. N. Y. Bot. Gard. 7: 44. 1927. *Plectonema flexuosum* Gardn. ibid. 7: 47. 1927. *Scytonema tenue* Gardn.[1] ibid. 7: 78. 1927. *S. Gardneri* J. DeToni

description and figure of *C. Kuetzingianum* the protoplasts are represented as spherical; but even a careless observer will note that Nägeli's illustrations are as idealized and mechanically perfect as the superb logic of his arrangement of the "unicellular" algae—his spherical plants and protoplasts are perfect circles; his precise and symmetrical arrangement of cells in the plants could never be matched with actual specimens. Moreover, Nägeli describes the habitat as "Gräben," what might be called "ditches" in English; but it is conceivable to us that ditches may easily become filled with heavy waterblooms, especially if situated on the leeward side of a lake. In Unger's description and figure of *C. Naegelianum* we receive the impression of an organism exactly similar to Nägeli's *C. Kuetzingianum*, with spherical protoplasts and no pseudovacuoles, but the plants (not the protoplasts) larger and covered externally with hairs (bacteria?). The plants grew as a true waterbloom "im grossen Bassin des botanischen Gartens in Grätz." Can it be that the authors of the two manuals now in vogue have made an arbitrary distinction between the species solely on the basis of a literal interpretation of the words "Gräben" and "Bassin"? Less recent authors, as pointed out by Forti, Syll. Myxophyc. 100 (1907), have based their distinctions between *C. Kuetzingianum* and *C. Naegelianum* upon the size of the plants, as originally stated by Unger. Original specimens of other species listed here in synonymy were examined as follows, SILESIA: auf einem Teiche am Schlosse von Habendorf, Kr. Reichenbach, *Hilse*, Sept. 1862 (isotype of *Coelosphaerium Wichurae* in Rabenh. Alg. 1523, FM, N). ITALY: in aquariis horti botanici Genuensis, *de Notaris*, 1868–69 (isotype of *Hydroepicoccum genuense* in Rabenh. Alg. 2127, F, FM, N).—F. DROUET AND W. A. DAILY.

[1] Isotypic material of this species and of *S. Gardneri* J. DeToni, PUERTO RICO: on rocks by a reservoir, Rio Piedras, *Wille 106*, Dec. 1914, in the Herbarium of the University of California consists of plants typical in every respect of specimens of *Fischerella ambigua* cited by Gomont.

Noter. Nomencl. Algol. 1: 7. 1934.—On wet rocks and soil, subaerial or aerial. Specimens seen, CALIFORNIA: San Bernardino county: Arrowhead hot springs, *Gardner 5, 15,* May 1930.

HAPALOSIPHON PUMILUS (Kütz.) Kirchn. ex B. & F. ibid. 5: 61. 1887. *H. fontinalis* (Ag.) Born. Bull. Soc. Bot. Fr. 36: 156. 1889. *H. brasiliensis* Borge Ark. f. Bot. 15 (13): 94. 1919.—In fresh water. The one specimen referred here is incrusted with lime, and for this reason the filaments exhibit certain peculiarities of growth. *H. pumilus* appears rarely in general collections of algae from western North America. CALIFORNIA: Inyo county: on sides of a wood flume about 1 mile east of Furnace Creek inn, Death valley, *Groesbeck 16,* Feb. 1940.

HAPALOSIPHON LAMINOSUS (Kütz.) Hansg. ex B. & F. ibid. 5: 55. 1887. *Nostoc caladarium* Wood ex B. & F. (as sp. inquir.) ibid. 7: 221. 1888; Wood Amer. Journ. Sci. ser. 2, 46: 33. 1868. *Hapalosiphon major* Tild. Amer. Alg. 2: 167. 1896.—In shallow water and on wet substrata in and about hot springs. Temperatures of the water from which the collections below were taken range from cold to 150° F., the greater number in the vicinity of 120° F. Bornet & Flahault (loc. cit.) and more recently Boye Petersen in Bot. Icel. 2 (2): 307ff. (1928) have reviewed the voluminous literature on this species and have pointed out the diversity of forms assumed by the filaments under various conditions of growth. Specimens seen, NEVADA: Washoe county: in the run-off of the largest spring and below a leaking pipe from a hot tank, Steamboat, *Groesbeck 110, 377,* June 1940, Apr. 1941. CALIFORNIA: Modoc county: hot springs in southwestern part of county, *Hall & Babcock,* June 1903. Mono county: in hot springs, streams, and spray, Fales hot springs, *Groesbeck 26, 186, 189, 356,* 1940–41; hot springs in the travertine quarry near Bridgeport, *Groesbeck 179, 462,* Sept. 1940, July 1941; Benton hot springs, *Mrs. Partz,* Aug. 1866 (TYPE of *Nostoc caladarium* in the Academy of Natural Sciences, Philadelphia; isotype, FM), *Duran 7795,* Apr. 1935; around steam vent, Paoha island, Mono lake, *Groesbeck 86,* June 1940. Inyo county: mouth of a steaming vent, the Geysers, *Groesbeck 136,* Sept. 1940; in a hot spring and in the basins of the hydraulic ram and the pump-pit, Keough hot springs, *Groesbeck 69, 147, 225, 313, 394,* 1940–41. San Bernardino county: Waterman hot springs, *Setchell 1552,* Dec. 1896; Arrowhead hot springs, *Setchell 1543, 1854,* Dec. 1896, Apr. 1898 (Phyc. Bor.-amer. 858, FM), *Gardner 7795a,* June 1929, *Parks 3245a,* Dec. 1929, *Gardner 20, 24, 25,* May 1930.

Nostocaceae

NOSTOC LINCKIA (Roth) Born. ex B. & F. Ann. Sci. Nat. VII Bot. 7: 192. 1888.—In shallow fresh water. Specimens seen, CALIFORNIA: Modoc county: in north fork of Pit river, Alturas, *Drouet & Richards 4148, 4172,* Sept. 1941. Mono county: on the sides of a cool spring, Fales hot springs, *Groesbeck 355,* Apr. 1941; in a spring in the travertine quarry, Bridgeport, *Groesbeck 458,* July 1941. Inyo county: with *N. spongiiforme* in cold water, Little lake, *Groesbeck 149,* Sept. 1940.

NOSTOC CARNEUM (Lyngb.) Ag. ex B. & F. ibid. 7: 196. 1888.—In shallow fresh water. Specimens seen, CALIFORNIA: Modoc county: in sloughs and in north fork of Pit river, Alturas, *Drouet & Richards 4136, 4140, 4164,* Sept. 1941. Inyo county: Little lake, *Groesbeck 222,* Nov. 1940. San Bernardino county: Harlem hot springs, *Setchell 1558,* Dec. 1896.

NOSTOC RIVULARE Kütz. ex B. & F. ibid. 7: 195. 1888.—In shallow fresh water. One collection, CALIFORNIA: Modoc county: north fork of Pit river, Alturas, *Drouet & Richards 4152,* Sept. 1941.

NOSTOC SPONGIIFORME Ag. ex B. & F. ibid. 7: 197. 1888.—In shallow fresh water. Specimens seen, CALIFORNIA: Inyo county: Little lake, *Groesbeck 149,* Sept. 1940. San Bernardino county: in water along upper trail, Arrowhead hot springs, *Gardner 21,* May 1930.

NOSTOC ELLIPSOSPORUM (Desmaz.) Rabenh. ex B. & F. ibid. 7: 198. 1888.—On wet rocks and soil. One specimen, CALIFORNIA: Riverside county: Palm canyon near Palm Springs, *Hollenberg 1613,* Mar. 1935.

NOSTOC MUSCORUM Ag. ex B. & F. ibid. 7: 200. 1888.—In wet ground, developing most conspicuously on mud along streams and in depressions exposed to the sun. Specimens seen: CALIFORNIA: Modoc county: on mud along the north fork of Pit river, Alturas, *Drouet & Richards 4146, 4158, 4165, 4166, 4168, 4169, 4188,* Sept. 1941; on mud beside an irrigation ditch in the hills 2 miles northwest of Alturas, *Drouet & Richards 4115, 4117, 4131a,* Sept. 1941. San Bernardino county: in a depression near Mountain Spring camp northeast of Essex, *Drouet & Macbride 4613,* Oct. 1941; along an intermittent stream 10 miles northwest of Vidal, *Drouet & Macbride 4668,* Oct. 1941. Imperial county: on moist ground along irrigation ditches between Brawley and Imperial, *Drouet & Macbride 4816, 4819,* Oct. 1941; in a ditch just east of Heber, *Drouet & Macbride*

4811, Oct. 1941. ARIZONA: on an alluvial flat by Colorado river below the old Spanish fort, Yuma, *Drouet 3444*, Dec. 1939.

NOSTOC COMMUNE Vauch. ex B. & F. ibid. 7: 203. 1888.—On wet or dry open ground, seldom seen in intermittent pools. Two collections, CALIFORNIA: Modoc county: on mud in sloughs along north fork of Pit river, Alturas, *Drouet & Richards 4157, 4167*, Sept. 1941.

NOSTOC SPHAERICUM Vauch. ex B. & F. ibid. 7: 208. 1888.—On rocks, wood, and other objects in flowing fresh water, chiefly in streams. Specimens seen, CALIFORNIA: Inyo county: on grass stems in a stream between highly alkaline pools beside railroad 1 mile north of Shoshone, *Groesbeck 21*, Feb. 1940. Riverside county: on stones in Snow creek, north side of San Jacinto mountains, *Hollenberg 1560, 4436*, Apr., Sept. 1934 (D).

NOSTOC AMPLISSIMUM Setch. Erythea 7: 50, pl. 2, 3. 1899.—On stones on the bottom in flowing water of streams. Specimens seen, NEVADA: Humboldt county: Humboldt river, Winnemucca, *D. Griffiths*, July 1901 (as *N. verrucosum* in Tild. Amer. Alg. 583b, FM). Lincoln county: Vegas valley, *Coville & Funston 391*, 1891 (D, F). CALIFORNIA: Modoc county: on stones in north fork of Pit river, Alturas, *Drouet & Richards 4134*, Sept. 1941.

NOSTOC PARMELIODES Kütz. ex B. & F. ibid. 7: 219. 1888.—On stones in shallow flowing water of streams. Specimens seen, CALIFORNIA: San Bernardino county: in rapid stream, Bear valley, *Parish 2308*, June 1892 (C); on stones in stream, Camp La Verne, Jenks lake, *Hollenberg 1559*, May 1934 (D). Riverside county: in the stream in Tahquitz canyon near Palm Springs, *Drouet & Macbride 4738*, Oct. 1941.

ANABAENA VARIABILIS Kütz. ex B. & F. ibid. 7: 226. 1888.—In shallow fresh or slightly brackish water. Specimens seen, CALIFORNIA: Modoc county: in north fork of Pit river, Alturas, *Drouet & Richards 4185*, Sept. 1941. San Bernardino county: scum on ditch near Mentone, *Hollenberg 3163*, Feb. 1941.

ANABAENA INAEQUALIS (Kütz.) B. & F. ibid. 7: 231. 1888.—In shallow fresh water. One specimen, CALIFORNIA: Riverside county: in trickle from rocky side of Palm canyon, near Palm Springs, *Hollenberg 1645*, Mar. 1935.

ANABAENA CATENULA (Kütz.) B. & F. ibid. 7: 232. 1888.—In shallow fresh water. One collection, CALIFORNIA: Modoc county: north fork of Pit river, Alturas, *Drouet & Richards 4187*, Sept. 1941.

ANABAENA OSCILLARIOIDES Bory ex B. & F. ibid. 7: 233. 1888.—In shallow fresh water. In both collections cited here the spores are immature, CALIFORNIA: San Bernardino county: in seeping rivulet by roadside near Big Bear lake, *Hollenberg 1567a*, Aug. 1934; Big Bear lake, *Hollenberg 1644*, Aug. 1934.

CYLINDROSPERMUM MUSCICOLA Kütz. ex B. & F. ibid. 7: 254. 1888. *C. caeruleum* Dick. ex B. & F. ibid. 7: 255. 1888.—In wet ground, less often seen in shallow water. One collection, CALIFORNIA: Modoc county: with *Schizothrix purcellii* on wet ground in the hills 2 miles northwest of Alturas, *Drouet & Richards 4119*, Sept. 1941.

CYLINDROSPERMUM LICHENIFORME (Bory) Kütz. ex B. & F. ibid. 7: 253. 1888.—In wet ground and in shallow fresh water. Specimens seen, CALIFORNIA: Modoc county: on the shore of the north fork of Pit river, Alturas, *Drouet & Richards 4179*, Sept. 1941. Riverside county: on rocks in the stream in the lower part of Palm canyon near Palm Springs, *Drouet & Macbride 4731*, Oct. 1941.

CYLINDROSPERMUM MAJUS Kütz. ex B. & F. ibid. 7: 252. 1888. *C. janthinum* Dick. ex B. & F. ibid. 7: 255. 1888.—In wet ground and in shallow water. Specimens seen: CALIFORNIA: San Bernardino county: in Barton creek above Camp La Verne, San Bernardino mountains, *Hollenberg 1565*, Aug. 1935; in seeping rivulet by roadside near Big Bear lake, *Hollenberg 1567*, Aug. 1934.

NODULARIA HARVEYANA (Thw.) Thur. ex B. & F. ibid. 7: 243. 1888.—In shallow fresh and brackish water. Specimens seen, CALIFORNIA: Mono county: in a cool spring and with *Hydrocoleum Groesbeckianum* in a stream at the travertine quarry near Bridgeport, *Groesbeck 90, 271*, June, Nov. 1940. San Bernardino county: in the bed of a desiccated lake, Hinkley station, *Drouet & Macbride 4569*, Oct. 1941.

NODULARIA SPUMIGENA Mert. ex B. & F. ibid. 7: 245. 1888.—In fresh and brackish water, not uncommonly found in wet ground. One collection, CALIFORNIA: Modoc county: with *Cylindrospermum licheniforme* on the shore of the north fork of Pit river, Alturas, *Drouet & Richards 4179*, Sept. 1941.

Rivulariaceae

AMPHITHRIX JANTHINA (Mont.) B. & F. Ann. Sci. Nat. VII Bot. 3: 344. 1886. *Inactis ecalcarea* Gardn.[1] Mem. N. Y. Bot. Gard. 7:

[1] See footnote, p. 158.

54. 1927. *Schizothrix rhodochlamys* Lillick[1] Rév. Algol. 9 (1): 141. 1937.—On rocks, wood, etc. in flowing fresh water. Specimens seen, NEVADA: Washoe county: in a drinking fountain in the park, Reno, *Drouet & Richards 4112*, Sept. 1941; in a cold stream, Steamboat, *Groesbeck 294*, Nov. 1940. CALIFORNIA: Mono county: in a cold stream in the travertine quarry near Bridgeport, *Groesbeck 103*, June 1940. Inyo county: on wood in Little lake, *Groesbeck 155, 381*, Sept. 1940, July 1941; on Ruppia in a salt pool, Death valley, *Groesbeck 216*, Oct. 1940.

CALOTHRIX BRAUNII B. & F. ibid. 3: 368. 1886. *Inactis obscura* Dick. ex Gom. idem 15: 329. 1892.—On rocks, etc., usually in flowing fresh water. Specimens seen, CALIFORNIA: Inyo county: on dead plant stems in shallow water of a small cold lake just south of Lone Pine, *Groesbeck 79*, June 1940. Riverside county: on rocks in the stream in Tahquitz canyon near Palm Springs, *Drouet & Macbride 4745*, Oct. 1941.

CALOTHRIX PARIETINA (Näg.) Thur. ex B. & F. ibid. 3: 366. 1886. *Mastigothrix turgida* Wolle ex Forti Syll. Myxophyc. 632. 1907.—Aerial, subaerial, and submersed in fresh water. Specimens seen, NEVADA: Washoe county: on the walls of a cool tank and on the ground about it, Steamboat, *Groesbeck 191, 278, 376, 428, 429*, 1940–41; in a small spring and a cold stream, Steamboat, *Groesbeck 116, 194, 362, 447, 448*, 1940–41. CALIFORNIA: Mono county: on a wet rock by the stream from the large spring, Fales hot springs, *Groesbeck 188*, Sept. 1940; floating and in crusts on plant-stems etc. in cold and tepid springs, pools, and bogs at the travertine quarry near Bridgeport, *Groesbeck 42, 95, 248, 251, 269, 335, 344, 480, 483*, 1940–41. Inyo county: on a stone and on submerged wood in Little lake, *Groesbeck 224, 306*, Nov. 1940, Apr. 1941. Riverside county: on rocks in the stream in the lower part of Palm canyon near Palm Springs, *Drouet & Macbride 4730*, Oct. 1941.

CALOTHRIX ADSCENDENS (Näg.) Thur. ex B. & F. ibid. 3: 365. 1886. *C. violacea* (Wolle) Forti Syll. Myxophyc. 619, 1907. *Mastigonema violaceum* Wolle ex Forti loc. cit. 1907. *M. fuscum* Wolle ex Forti ibid. 618. 1907. *Calothrix Fortii* J. DeToni Noter. Nomencl. Algol. 1: 6. 1934.—Growing attached to larger plants in fresh water. One specimen, CALIFORNIA: Mono county: on plant-stems in a

[1] Isotypic specimens of *Inactis ecalcarea* Gardn. [PUERTO RICO: on stones in Turabo river, Caguas, *N. Wille 481a*, Jan. 1915 (C)] and *Schizothrix rhodochlamys* Lillick [OHIO: stream east of Cincinnati, *W. H. Buchler*, 1932 (D)] appear to be typical *Amphithrix janthina*.

large cold spring at the travertine quarry, Bridgeport, *Groesbeck 341*, Apr. 1941.

CALOTHRIX THERMALIS (Schwabe) Hansg. ex B. & F. ibid. 3: 368. 1886.—In shallow water and on wet rocks in and about hot springs. Specimens seen, CALIFORNIA: Mono county: in a pool and in the overflow from the end of a travertine ridge at the travertine quarry near Bridgeport, *Groesbeck 41*, *463*, Apr. 1940, July 1941. San Bernardino county: Arrowhead hot springs, *Parks 3247b*, Dec. 1929, *Setchell 1536*, *1542*, *1546*, Dec. 1896; Waterman hot springs, *Setchell 1552*, *1556*, *1557*, Dec. 1896.

DICHOTHRIX **inyoensis, sp. nov.** Stratum fuscum et fusco-aerugineum late expansum, calce plus minusve incrustatum, filis saepe penicillato-caespitosis longis gracilibus, basin usque ad 60 μ crassis, superne ramosis, pseudoramis ultimis usque ad 50 μ crassis; vaginis cylindraceis crassis gelatinosis uniformiter lamellosis, ad apices primum hyalinis, inferiore luteis vel fuscis; trichomatibus (in mediis partibus pseudoramorum ultimorum) usque ad 25 μ crassis, cylindraceis, superne in pilum longiorem attenuatis; articulis primum brevibus demum subquadratis vel diametro usque ad 3-plo longioribus; heterocystis basalibus sphaericis vel subsphaericis, heterocystis intercalaribus cylindraceis.—This new species is similar in many respects to *D. Hosfordii* (B. & F.) Born.; it differs from the latter mainly in its longer and more robust filaments, which have the general appearance of those of *Scytonema Myochrous* B. & F. Occasionally scytonematoid branching is found in the filaments. One specimen, CALIFORNIA: Inyo county: in a very shallow pool in a salt playa on the floor of Death valley 35.7 miles south of Furnace creek on the east highway, *Groesbeck 3*, Feb. 1940 (TYPE in the Cryptogamic Herbarium, Field Museum).

DICHOTHRIX ORSINIANA (Kütz.) B. & F. ibid. 3: 376. 1886.—On wet rocks etc. Specimens seen, CALIFORNIA: San Bernardino county: Arrowhead hot springs, *Setchell 1538*, Dec. 1896; on spray-covered rocks, Manker flats, Mount Baldy, *M. Stewart*, Oct. 1934.

DICHOTHRIX GYPSOPHILA (Kütz.) B. & F. ibid. 3: 377. 1886.—On wet substrata in fresh water. Specimens seen, CALIFORNIA: Inyo county: Death valley, *Parish* (C). San Bernardino county: on spray-covered cliffs at falls, Manker flats, Mount Baldy, *Hollenberg 1612*, Apr. 1934. Riverside county: on wet rocks in Palm canyon near Palm Springs, *Hollenberg 1640*, Mar. 1935.

RIVULARIA HAEMATITES (DC.) Ag. ex B. & F. ibid. 4: 350. 1886. *Dichothrix calcarea* Tild.[1] Amer. Alg. 2: 165. 1896. *Lyngbya Mar-*

tensiana var. *calcarea* Tild.[1] ibid. 2: 178. 1896.—On rocks and other substrata in fresh water. One specimen, CALIFORNIA: Inyo county: in a cold pool beside the railroad 1 mile north of Shoshone, *Groesbeck 20*, Feb. 1940.

GLOEOTRICHIA NATANS (Hedw.) Rabenh. ex B. & F. ibid. 4: 369. 1886. *Rivularia natans* (Hedw.) Welw. ex B. & F. loc. cit. 1886. *Calothrix scytonemicola* var. *brasiliensis* Borge Ark. f. Bot. 19 (17): 5. 1925. *Rivularia* (*Gloeothrichia*) *flagelliformis* Gardn. Mem. N. Y. Bot. Gard. 7: 71. 1927.—In shallow fresh water. Specimens seen, CALIFORNIA: Modoc county: in sloughs along the north fork of Pit river, Alturas, *Drouet & Richards 4159*, Sept. 1941. Inyo county: in Little lake, *Groesbeck 151a*, Sept. 1940.

Scytonemataceae

FREMYELLA DIPLOSIPHON (B. & F.) Drouet Field Mus. Bot. Ser. 20: 32. 1939. *Microchaete diplosiphon* Gom. ex B. & F. Ann. Sci. Nat. VII Bot. 5: 84. 1887.—With other algae in strata in small more or less permanent bodies of water. It is possibly a growth-form of *Calothrix parietina* B. & F. One specimen, CALIFORNIA: Mono county: in a small cold pool in the travertine quarry near Bridgeport, *Groesbeck 43*, Apr. 1940.

AULOSIRA IMPLEXA B. & F. ibid. 7: 257. 1888. *Microchaete tenera* var. *tenuior* Gardn.[2] Mem. N. Y. Bot. Gard. 7: 71. 1927. *Fremyella tenera* var. *tenuior* J. DeToni[2] Archivio Bot. 15: 290. 1939.—In shallow fresh water. Specimens seen, CALIFORNIA: Inyo county: in a warm spring up Furnace creek wash about 1 mile from the hotel, Death valley, *Grinnell 7622*, Oct. 1933. San Bernardino county: Arrowhead hot springs, *Setchell 1544*, Dec. 1896, *Parks 3248*, Dec. 1929.

SCYTONEMA MYOCHROUS (Dillw.) Ag. ex B. & F. ibid. 5: 104. 1887.—On wet rocks, less often seen in very shallow fresh water. One collection, CALIFORNIA: San Bernardino county: in spray of falls, Manker flats near Mount Baldy, *Hollenberg 1657*, Apr. 1934.

SCYTONEMA FIGURATUM Ag. ex B. & F. ibid. 5: 101. 1887. *S. mirabile* (Ag.) Born. Bull. Soc. Bot. Fr. 36: 155. 1889 [not Wolle].

[1] Presumably isotypic material of *Dichothrix calcarea* and *Lyngbya Martensiana* var. *calcarea*, MINNESOTA: on sides of old wooden tank, Minneapolis, *J. E. Tilden*, Oct. 1895 (Tild. Amer. Alg. 165, 178, FM), is typical *Rivularia haematites*.

[2] The isotype of this variety in the Herbarium of the University of California, PUERTO RICO: among hepaticae by the road near Adjuntas, *N. Wille 1571*, Mar. 1915, contains underdeveloped filaments of *Aulosira implexa*.

S. caldarium Setch. Erythea 7: 48, pl. 3, f. 3. 1899. *S. pulchellum* Gardn.[1] Mem. N. Y. Bot. Gard. 7: 76. 1927. *S. guyanense* var. *minus* Gardn.[1] ibid. 7: 79. 1927. *S. multiramosum* Gardn.[1] ibid. 7: 81. 1927.—On wet substrata and in fresh water. Study of considerable amounts of the type material in the Herbarium of the University of California and in the Cryptogamic Herbarium of Field Museum shows that *S. caldarium* should more properly be considered a synonym of *S. figuratum* than of *S. stuposum* B. & F., as I proposed in Field Mus. Bot. Ser. 20: 38 (1939). The sheaths are chiefly colorless and thin, but they exhibit the irregular thickening behind the apices which is characteristic of those of *S. figuratum*. Specimens seen, CALIFORNIA: Inyo county: Nevares spring near Cow creek, Death valley, *Munz 2280*, Apr. 1937 (D). San Bernardino county: Waterman hot springs, *Parish*, Apr. 1897 (TYPE of *S. caldarium* in herb. Univ. Calif.; isotypes in Phyc. Bor.-amer. 559), Setchell 1554, Dec. 1896; Arrowhead hot springs, *Parks 3248a*, Dec. 1929, *Gardner 22, 26*, May 1930.

SCYTONEMA TOLYPOTRICHOIDES Kütz. ex B. & F. ibid. 5: 100. 1887.—In shallow fresh water. Specimens seen, CALIFORNIA: San Bernardino county: Arrowhead hot springs, *Setchell 1537*, Dec. 1896, *Gardner 12, 13, 51*, May 1930; Waterman hot springs, *Setchell 1549*, Dec. 1896.

SCYTONEMA OCELLATUM Lyngb. ex B. & F. ibid. 5: 95. 1887. *S. ocellatum* var. *constrictum* Gardn.[2] Mem. N. Y. Bot. Gard. 7: 79. 1927. *S. spirulinoides* Gardn.[2] ibid. 7: 80. 1927. *S. tenellum* Gardn.[2] loc. cit. 1927.—On soil, rocks, and trees wet periodically by rains. Specimens seen, CALIFORNIA: San Bernardino county: in open ground in a ravine just east of South pass 12 miles west of Needles, *Drouet & Macbride 4604*, Oct. 1941. Riverside county: in barren ground in open scrub-forest near Desert Center, *Drouet & Macbride 4710, 4718*, west of Shavers Summit, *Drouet & Macbride 4701*, Oct. 1941. Imperial county: in barren spots in an open field at the south edge of Brawley, *Drouet & Macbride 4775*, Oct. 1941.

[1] Gardner's isotypes of *S. pulchellum* (on rocks near Utuado, *N. Wille 1574*, Mar. 1915), *S. guyanense* var. *minus* (between Arecibo and Utuado, *Wille 1455*), and *S. multiramosum* (10 km. north of Utuado, *Wille 1527*, Mar. 1915) from Puerto Rico in the Herbarium of the University of California appear to be easily recognizable specimens of *S. figuratum*.

[2] Gardner's isotypes of *S. ocellatum* var. *constrictum* (on rocks by the road north of Maricao, *Wille 1253*, Feb. 1915), *S. spirulinoides* (on rocks along the road, Coamo to San Lorenzo, *Wille 534*, Jan. 1915), and *S. tenellum* (north of Sabana Grande, *Wille 936a*) from Puerto Rico in the Herbarium of the University of California are all typical specimens of *S. ocellatum* B. & F.

SCYTONEMA HOFMANNII Ag. ex B. & F. ibid. 5: 97. 1887. *S. cortex* f. *corrugatum* Wolle F. W. Alg. U. S. 257. 1887. *S. cortex* f. *brunneum* Wolle ibid. 258. 1887. *S. Hofmannii* f. *brunneum* Wolle apud Forti Syll. Myxophyc. 515. 1907. *S. subgelatinosum* Gardn.[1] Mem. N. Y. Bot. Gard. 7: 74. 1927.—On rocks, soil, and other substrata kept wet with fresh water permanently or during the greater part of the year. Specimens seen, CALIFORNIA: San Bernardino county: on the wall of a hot tank north of the hotel, Arrowhead hot springs, *Gardner 3*, May 1930. Riverside county: on mud on the shore of the Colorado river 10 miles south of Vidal, *Drouet & Macbride 4646*, Oct. 1941.

SCYTONEMA STUPOSUM Born. ex B. & F. ibid. 5: 92. 1887. *S. occidentale* Setch.[2] Erythea 7: 49, pl. 3, f. 4. 1899. *S. azureum* Tild. Amer. Alg. 7: 630. 1909.—On rocks etc. kept wet with fresh water during the greater part of the year. Specimens seen, CALIFORNIA: San Bernardino county: Arrowhead hot springs, *Setchell 1541*, Dec. 1896. Imperial county: on stones in Snow creek, San Jacinto mountains, *Hollenberg 1658*, 1934.

Oscillatoriaceae

PORPHYROSIPHON FUSCUS Gom. apud Frémy Bull. Mus. Hist. Nat. Paris 33: 115. 1927.—On soil wet occasionally by rains, most frequently seen in this region on soil in crevices of rocks. Specimens seen, CALIFORNIA: San Bernardino county: rocks near Needles, Essex, and Bagdad, *Drouet & Macbride 4599, 4610, 4634a*, on barren ground 10 miles northwest of Vidal, *Drouet & Macbride 4665*, Oct. 1941. Riverside county: rocks by Colorado river 10 miles south of Vidal, *Drouet & Macbride 4658*, barren ground west of Desert Center, *Drouet & Macbride 4713*, Oct. 1941.

SCHIZOTHRIX **acutissima, sp. nov.** Stratum pannosum friabile arenosum, aerugineum vel pallide roseum vel decoloratum, ad millimetrum crassum, filis passim elongatis intricatis sparse ramosis, passim brevibus atque fasciculato-ramosis; vaginis firmis hyalinis, aetate provecta luteis, primum arctis demum crassioribus et plus minusve gelatinosis, apice acutis, chlorozincico iodurato haud

[1] Isotypic material of *S. subgelatinosum* in the Herbarium of the University of California (PUERTO RICO: on rocks near a reservoir in Rio Piedras, *Wille 108*, Dec. 1914) contains a parasitized mass of *S. Hofmannii* in which the sheaths have become swollen.

[2] The TYPE of *S. occidentale* in the Herbarium of the University of California (CALIFORNIA: La Jota falls near St. Helena, Napa county, *Setchell 1095*, Nov. 1895) appears to me to be similar to other specimens of *S. stuposum*.

caerulescentibus; trichomatibus aerugineis, 4 μ ad 6 μ crassis, intra vaginas basin pluribus supra solitariis vel duabus, cylindricis, ad genicula constrictis, ad apices longe et sensim attenuatis atque acuminatis; articulis subquadratis vel diametro usque duplo brevioribus, protoplasmate tenui-granuloso, dissepimentis non aut obscure granulatis; cellula apicali longe et acutissime conica.—Fig. 1. This species belongs in the Section Chromosiphon of Gomont near *S. Muelleri* Gom., from which it differs markedly in dimensions of

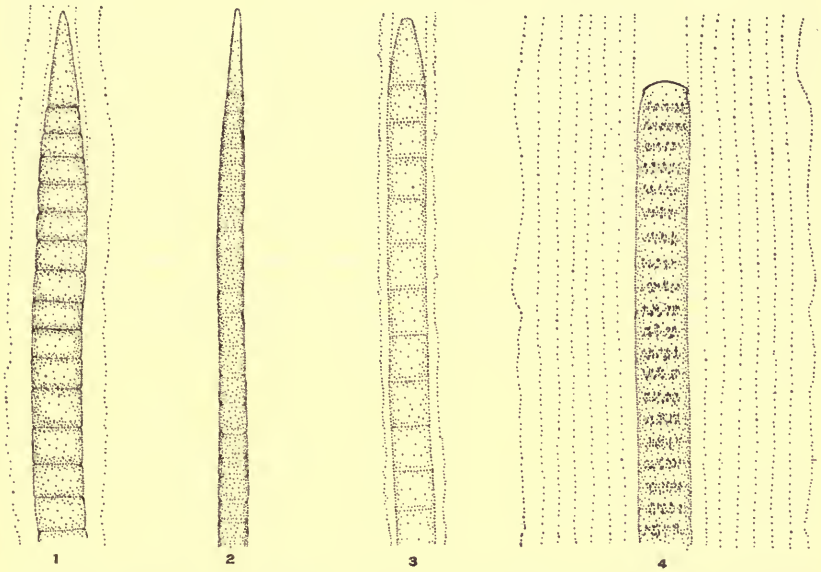

Fig. 1. *Schizothrix acutissima.* Fig. 2. *S. Macbridei.* Fig. 3. *S. californica.* Fig. 4. *Hydrocoleum Groesbeckianum.* Mature apices of the trichomes in these species as represented in the type specimens.

all parts, in the configuration of the apical cell, and in the general character of the sheath. It is a plant of sandy desert places, forming pannose strata with other vaginate myxophyceae in the slightest depressions on dunes and barren plains. The strata are usually impregnated with sand and silt. Specimens seen, COLORADO: Fremont county: in high red clay barrens along highway 115 about 20 miles northeast of Canon City, *Drouet & A. Cohen 4951*, July 1942. CALIFORNIA: San Bernardino county: on the plain near Piute station northeast of Essex, *Drouet & Macbride 4615*, along an intermittent stream 10 miles northwest of Vidal, *Drouet & Macbride 4667, 4770*, Oct. 1941. Imperial county: on sand dunes north of Mount Signal, *Drouet & Macbride 4798* (TYPE in Cryptogamic

Herbarium of Field Museum), on a sandy plain at Plaster City, *Drouet & Macbride 4794*, Oct. 1941. San Diego county: on a hillside west of Boulevard, *Drouet & Macbride 4837*, in open thickets at the south edge of Jacumba, *Drouet & Macbride 4847*, Oct. 1941.

SCHIZOTHRIX MACBRIDEI Drouet Amer. Midl. Nat. 29: 51. 1943.—Growing with other algae in thin crusts on silt in the slightest depressions in open ground in the deserts. Fig. 2. Specimens seen, CALIFORNIA: San Bernardino county: in rocky rolling ground near Mountain Spring camp northeast of Essex, *Drouet & Macbride 4614*, on black lava-flows east of Bagdad. *Drouet & Macbride 4636* (TYPE), on the alluvial bank of an intermittent stream 10 miles northwest of Vidal, *Drouet & Macbride 4672*, Oct. 1941. Riverside county: in a depression on an open gravelly hillside 5 miles east of Indio, *Drouet & Macbride 4700*, in open scrub-forest near Hopkins Well, *Drouet & Macbride 4725, 4728*, in open sandy woods between Arabia and Mecca, *Drouet & Macbride 4772, 4774*, Oct. 1941. Imperial county: on a sandy plain by Salton sea between Pope and Frink stations, *Drouet & Macbride 4763*, on a rocky hillside west of Coyote Well, *Drouet & Macbride 4791*, along irrigation ditches between Brawley and Imperial, *Drouet & Macbride 4818*, Oct. 1941.

SCHIZOTHRIX PURCELLII W. R. Taylor Proc. Acad. Nat. Sci. Phila. 80: 91, pl. 12, f. 7–9. 1928. Fila inter alias algas et muscos terrestres crescentia, longa, gracilia, superne fasciculato-ramosa, saepe in fasciculos erectos breves contorta, vaginis hyalinis crassis gelatinosis obscure lamellosis, ambitu erosis, chlorozincico iodurato caerulescentibus; trichomatibus laete aeruginosis, cylindraceis, 3 μ ad 5 μ crassis, ad genicula non (aut passim paullo) constrictis, ad apices abrupte attenuatis, intra vaginam inter se distantibus; articulis subquadratis vel diametro usque duplo longioribus, protoplasmate passim granuloso, dissepimentis non granulatis; cellula apicali conica.—On wet barren ground, perhaps often inundated. In Rhodora 40: 226, footnote 1 (1938) I interpreted the type material of this species as *S. Friesii* Gom. More recent collections from other parts of its range, however, show that *S. purcellii* as described above is a distinctive species similar to *S. Friesii* but with trichomes mostly unconstricted and with broad gelatinous sheaths. The epithet "purcellii" is properly written here with a small initial letter, since the species is named for the Purcell mountain range. Specimens seen, COLORADO: soil in elymetum on boulderfield, Longs peak, Rocky Mountain national park, *W. Kiener 3253a*, Sept. 1935; on wet rocks east of Berthoud pass, Clear Creek county, *W. L. Tol-*

stead 10181a, June 1942. BRITISH COLUMBIA: crust from nearly dried-up pool, parkland, Canon creek near Golden, Kootenay county, *W. R. Taylor*, Sept. 1923 (TYPE in the herbarium of Wm. Randolph Taylor; isotype, D); path above hotel, Glacier, Kootenay county, *Taylor*, 1927 (T, D). CALIFORNIA: Modoc county: on wet ground in the hills 2 miles northwest of Alturas, *Drouet & Richards 4119*, Sept. 1941.

SCHIZOTHRIX CALIFORNICA Drouet Amer. Midl. Nat. 29: 52. 1943.—Common in crusts of algae in barren ground in southern California, usually associated with *Microcoleus vaginatus* Gom. Fig. 3. Specimens seen, CALIFORNIA: San Bernardino county: near Cajon pass, Barstow, Hinkley station, Victorville, South pass, Essex, Piute station, Danby, Bagdad, Needles, Vidal, and Lobecks pass, *Drouet & Macbride 4543, 4549, 4552, 4561, 4563, 4564, 4566, 4595, 4604, 4608, 4611a, 4616, 4625, 4629, 4631, 4633, 4635, 4664, 4666, 4675, 4676, 4679, 4694, 4695*, Oct. 1941. Riverside county: on barren ground in open scrub-forest 2 miles southeast of Palm Springs, *Drouet & Macbride 4746* (TYPE), near Vidal, Indio, Shavers Summit, Desert Center, Hopkins Well, Blythe, Palm Springs, and Salton station, *Drouet & Macbride 4652, 4655, 4656, 4697, 4699, 4705, 4709, 4714, 4717–21, 4729, 4750, 4764*, Oct. 1941. Imperial county: Brawley, Coyote Well, and Imperial, *Drouet & Macbride 4777, 4790, 4815*, Oct. 1941.

SCHIZOTHRIX STRICKLANDII Drouet Amer. Midl. Nat. 29: 51. 1943.—In crusts of algae on barren ground. Specimens seen, CALIFORNIA: San Bernardino county: south of Needles, *Drouet & Macbride 4678, 4691*, Oct. 1941. Riverside county: 10 miles south of Vidal, *Drouet & Macbride 4654*, Oct. 1941.

SCHIZOTHRIX FRAGILIS (Kütz.) Gom. Ann. Sci. Nat. VII Bot. 15: 314. 1892.—On wet rocks. One collection, CALIFORNIA: San Bernardino county: Waterman hot springs, *Setchell 1555*, Dec. 1896.

SCHIZOTHRIX CALCICOLA (Ag.) Gom. ibid. 15: 307. 1892. *Hypheothrix calcicola* Rabenh. ex Gom. loc. cit. 1892. *Oscillatoria tortuosa* Gardn.[1] Mem. N. Y. Bot. Gard. 7: 34. 1927. *Plectonema tenuissimum* Gardn.[1] ibid. 7: 47. 1927.—On wet rocks, woodwork, etc. One specimen, CALIFORNIA: Mono county: on the walls of a small

[1] The filaments indicated by Gardner as *Oscillatoria tortuosa* (PUERTO RICO: Maricao, *Wille 1147a*, Feb. 1915) and as *Plectonema tenuissimum* (PUERTO RICO: Maricao, *Wille 1049b*) in the isotypes in the Herbarium of the University of California are here interpreted as young plants of *Schizothrix calcicola*, although the mass in each case is too scantily developed for better than an arbitrary decision on this point.

tepid spring at the travertine quarry near Bridgeport, *Groesbeck 343*, Apr. 1941.

SCHIZOTHRIX LARDACEA (Ces.) Gom. ibid. 15: 307. 1892. *Hypheothrix lardacea* Hansg. in Dalla Torre & Sarnth. Fl. Tirol 2: 144. 1901.—On wet rocks and soil. The Nevada specimens are placed here tentatively; the sheaths of these become impregnated with silica. Specimens seen, NEVADA: Washoe county: in a hot spring and pool, Steamboat, *Groesbeck 195b, 284, 367*, 1940, 1941. CALIFORNIA: Inyo county: first spring south of Triangle spring, Death valley, *Grinnell 7628*, Oct. 1933. San Bernardino county: Arrowhead hot springs, *Setchell 1540*, Dec. 1896.

SCHIZOTHRIX CORIACEA (Kütz.) Gom. ibid. 15: 309. 1892. *Hypheothrix coriacea* Kütz. ex Gom. loc. cit. 1892.—On wet rocks, woodwork, etc. One specimen, CALIFORNIA: Inyo county: in flume in Furnace creek wash, Death valley, *Groesbeck 299*, Jan. 1941.

SCHIZOTHRIX LACUSTRIS A. Br. ex Gom. ibid. 15: 301. 1892. *Inactis lacustris* (Gom.) Forti Syll. Myxophyc. 354. 1907.—On wet substrata and in shallow fresh water. Specimens seen, CALIFORNIA: Mono county: in a cold pool at the travertine quarry near Bridgeport, *Groesbeck 40, 158, 237, 242, 250, 348*, 1940–41.

HYDROCOLEUM **Groesbeckianum, sp. nov.** Stratum corrugato-crustaceum, ad centimetrum crassum, griseum vel roseum vel aerugineum, calce impregnatum, filis longis gracilibus basi ramosis, passim caespitosis passim intertextis; vaginis cylindraceis gelatinosis hyalinis crassis multi-lamellosis, ambitu erosis, chlorozincico iodurato haud caerulescentibus, ad apices longe acuminatis; trichomatibus aerugineis vel luteolis, 4 μ ad 8 μ crassis, cylindricis, ad genicula non constrictis, ad apices abrupte attenuatis et truncatis, intra vaginas praecipuius solitariis raro duabus vel pluribus; articulis brevibus, praecipue 2–5-plo brevioribus, nonnumquam subquadratis, dissepimentis grosse-granulato, protoplasmate tenuigranuloso; cellula apicali depresso-hemisphaerica vel quasi-truncata, superne membranam incrassatam praebente.—Fig. 4. In this new species, named in honor of M. J. Groesbeck, M. D., the trichomes are somewhat reminiscent of those of *H. heterotrichum* Gom. but are much smaller than in the latter species. The filaments grow as thick slightly calcified crusts submersed in cold pools and streams. Specimens seen, CALIFORNIA: Mono county: in the travertine quarry near Bridgeport, *Groesbeck 349*, Apr. 1941 (TYPE in Cryptogamic Herbarium of Field Museum), *Groesbeck 271, 272*, Nov. 1940.

MICROCOLEUS CHTHONOPLASTES (Fl. dan.) Thur. ex Gom. ibid. 15: 353. 1892.—In brackish and salt water and on mud. One specimen, CALIFORNIA: Inyo county: bottom of a brine-pool, salt playa on floor of Death valley 35.7 miles south of Furnace creek on the east highway, *Groesbeck 4*, Feb. 1940.

MICROCOLEUS **californicus, sp. nov.** Stratum pannosum expansum rubro-fuscum, filis longis gracilibus intertextis copiose ramosis, basin usque ad 30 trichomata includentibus; vaginis hyalinis crassis gelatinosis inconspicue lamellosis vel fibrosis, ambitu erosis vel levibus vel diffluentibus, chlorozincico iodurato ad apices aegre caerulescentibus; trichomatibus laete aerugineis, 3 μ ad 4 μ crassis, ad genicula constrictis; cellulis diametro usque ad 2½-plo longioribus, protoplasmate non aut sparsim grosse-granuloso, dissepimentis conspicuis; cellula apicali acute conica.—In shallow pools of alkaline water. This species has smaller trichomes than has *M. lacustris* Gom.; the sheaths become blue at the tips when treated with chlor-zinc-iodine. Specimens seen, CALIFORNIA: Mono county: in a cold pool in the travertine quarry, Bridgeport, *Groesbeck 168* (TYPE in the Cryptogamic Herbarium of Field Museum), *249, 252*, Sept., Nov. 1940. Inyo county: first spring south of Triangle spring, Death valley, *Grinnell 7627* (distributed as *Schizothrix rupicola*), Oct. 1933.

MICROCOLEUS **rupicola** (Tild.), **comb. nov.** *Schizothrix rupicola* Tild. Amer. Alg. 2: 175. 1896.—Stratum pannosum friabile aerugineum vel decoloratum, filis longis gracilibus, basin robustis cylindricis usque 50 trichomata includentibus, supra copiose ramosis, ramis solitaria vel plura trichomata includentibus; vaginis hyalinis crassis non aut obscure lamellosis, ambitu erosis vel corrugatis, chlorozincico iodurato caerulescentibus; trichomatibus laete aerugineis, 3 μ ad 4 μ crassis, ad genicula non aut paullo constrictis, ad apices attenuatis; cellulis diametro praecipuius 1½-plo longioribus, protoplasmate aerugineo, nonnumquam granuloso, dissepimentis non granulatis; cellula apicali longe conica, apice obtusa.—On exposed and barren ground, often found among mosses and young lichens. This is a species widely distributed in North America; many specimens have passed in the literature under the name *Schizothrix arenaria* Gom. *Microcoleus rupicola* belongs near *M. tenerrimus* Gom. and *M. acutissimus* Gardn. but differs markedly from the latter two in the configuration of the mature apical cells of the trichomes. Where the filaments have become parasitized by fungi, the sheaths are lamellose and corrugate and simulate those of

Schizothrix lacustris Gom. Among the many specimens on file in Field Museum, the following are chosen to illustrate the species and its distribution: MASSACHUSETTS: Gansett estate, Woods Hole, *Drouet 1217*, Aug. 1934. NEW JERSEY: Towaco, Morris county, *Drouet 2064*, June 1937. MARYLAND: Plummers island near Cabin John, Montgomery county, *E. C. Leonard 2880*, Nov. 1941, *Drouet, Killip, & Swallen 3920*, *Drouet & Killip 3959*, July 1941. VIRGINIA: U. S. experimental farm, Arlington, *F. E. Allison 24*, July 1937. INDIANA: bank of Whitewater river, Richmond, *L. J. King 200*, Sept. 1940. MINNESOTA: Soldiers' home, Minnehaha falls, Hennepin county, *C. W. Hall*, Sept. 1896 (isotype in Tild. Amer. Alg. 175). MISSOURI: Ashland, Boone county, *W. B. Drew 704A*, Aug. 1940; 4 miles west of California, Moniteau county, *Drouet 783*, Oct. 1930; bank of Blue river, Swope park, Kansas City, *R. Patrick*, Aug. 1938. NEBRASKA: 1 mile southeast of Wilsonville, *G. H. Giles 5*, Aug. 1937; Republican river near Oxford, *W. Kiener 11914*, Sept. 1941. COLORADO: Evergreen, Jefferson county, *Drouet & A. Cohen 4925*, July 1942. NEW MEXICO: 2 miles west of courthouse, Las Vegas, *Drouet & Richards 2578*, Oct. 1939. ARIZONA-NEVADA: Lake Mead, *E. U. Clover 82*, Apr. 1941. CALIFORNIA: San Bernardino county: south of Needles, *Drouet & Macbride 4677*, *4686*, *4689*, *4692*, Oct. 1941. Merced county: 5 miles east of Los Banos, *Drouet & Macbride 4393*, Oct. 1941. San Diego county: in a garden, Cardiff-by-the-Sea, *Drouet & Macbride 4862*, Oct. 1941. SONORA: along Rio de Sonora, Hermosillo, *Drouet & Richards 2869*, Nov. 1939. GUATEMALA: Laguna de Ocubilá east of Huehuetenango, *P. C. Standley 82663*, Jan. 1941; along Rio Samalá near Santa Maria de Jesús, Dept. Quezaltenango, *Standley 84746*, Jan. 1941; Zacapa, *Standley 74594*, Oct. 1940.

MICROCOLEUS VAGINATUS (Vauch.) Gom. ibid. 15: 355. 1892.—Ubiquitous on soil throughout at least the southern part of the region. A considerable number of strains with trichomes of various sizes and colors is concerned; and though vars. *Vaucheri* and *monticola* of Gomont can be distinguished in some collections, there appear to be several strains of these and numerous intermediate kinds. In high rocky and sandy areas, *M. vaginatus* along with species of Schizothrix and Porphyrosiphon forms a superficial crust wherever silt has collected on ground not occupied by larger plants or covered by decaying leaves. In depressions where water remains standing for some days after rains, the trichomes move out of the

sheaths and form phormidioid masses often confused with *Phormidium autumnale* Gom. and *P. uncinatum* Gom.[1] If the pool becomes permanent, this phormidioid state can be maintained over a long period of time. If the pool dries up, the *Microcoleus vaginatus* continues to grow as a stratum on the soil. Where such a stratum becomes desiccated in a very short time—as is usually the case in the hot deserts—the filaments are found almost invariably to contain single trichomes, and only here and there several. In places where the surface of the ground has been denuded in excavations for buildings and road-construction, this unitrichomatiferous form is also characteristic and almost always present on the cracked surface of the dried mud. Specimens seen, CALIFORNIA: Modoc county: on wet ground in the hills 2 miles northwest of Alturas, *Drouet & Richards 4128*, Sept. 1941. Inyo county: in fresh water, Little lake, *Groesbeck 75*, June 1940 (the phormidioid growth-form). San Bernardino county: near Cajon pass, Newberry, Hinkley station, Hawes station, Adelanto, Essex, Piute station, Danby, Bagdad, Needles, Lobecks pass, and Vidal, *Drouet & Macbride 4550, 4551, 4555, 4560, 4563, 4565, 4571, 4572, 4575, 4578, 4585, 4593, 4612, 4617, 4618, 4621a, 4623, 4637, 4671, 4674, 4690*, Oct. 1941. Riverside county: near Indio, Shavers Summit, Desert Center, Hopkins Well, and Salton Station, *Drouet & Macbride 4696, 4702, 4704, 4706, 4712, 4717, 4722, 4727, 4765, 4766, 4770*, Oct. 1941. Imperial county: by Salton sea between Pope and Frink stations, *Drouet & Macbride 4761*, Oct. 1941.

PLECTONEMA NOSTOCORUM Born. ex Gom. ibid. 16: 102. 1892. *Phormidium glaciale* W. & G. S. West[2] Brit. Antarct. Exped. 1907–9, Rept. Sci. Invest., Biol. 1 (7): 291. 1911. *P. scytonematicola* var. *minus* Gardn.[2] Mem. N. Y. Bot. Gard. 7: 42. 1927. *P. epiphyticum* Gardn.[2] N. Y. Acad. Sci. Sci. Surv. Porto Rico 8: 281. 1932.—Present in the gelatinous matrices of many algae but not developing in conspicuous masses while the "host" is actively growing. In small bodies of water which have stood for many

[1] It may be of interest here to point out that much of the phormidioid material appearing in water-cultures of soil algae is more probably the phormidioid growth-form of *Microcoleus vaginatus* than of *Phormidium antumnale* or *P. uncinatum*.

[2] Parts of the original material of *Phormidium glaciale* from Antarctica (Clear lake, Coast lake, and Blue lake, Ross island, *Shackleton Expedition*, 1908) in the Herbarium of the University of California are almost pure masses of *Plectonema Nostocorum*. Isotypes of *Phormidium scytonematicola* var. *minus* (PUERTO RICO: 10 km. north of Utuado, *Wille 1565a*) and *P. epiphyticum* (PUERTO RICO: Santurce, *Howe 2162b*, May 1903) in the Herbarium of the University of California contain typical filaments of *Plectonema Nostocorum*.

months—in culture-dishes, jars of water, urns in cemeteries, watering-troughs for animals, and small more or less permanent pools in which other algae have not continued to grow because of unfavorable conditions—this species is often the principal constituent of the climax association of algae. The same is true of associations of algae on exposed soil which remains wet for long periods of time. Specimens seen, NEVADA: Washoe county: in a cold stream, Steamboat, *Groesbeck 446*, July 1941. CALIFORNIA: Modoc county: on wet ground beside the north fork of Pit river, Alturas, *Drouet & Richards 4174*, Sept. 1941. Mono county: on a submerged tufa-crag, northwest portion of Mono lake, *Groesbeck 81*, June 1940. Inyo county: culture from Bad Water, Death valley, *Holman & Bonar 7800*, Apr. 1933; stream about ½ mile east of Furnace creek inn, Death valley, *Groesbeck 14*, Feb. 1940.

PLECTONEMA WOLLEI Farl. ex Gom. ibid. 16: 98. 1892. *Lyngbya magnifica* Gardn.[1] Mem. N. Y. Bot. Gard. 7: 40. 1927.—In streams and lakes. One collection, CALIFORNIA: Inyo county: in Furnace creek, Death valley, *Parish 10465*, May 1905 (C).

SYMPLOCA KIENERI Drouet Amer. Midl. Nat. 29: 53. 1943.—In barren depressions in sand. One specimen, CALIFORNIA: San Bernardino county: Santa Ana wash north of Redlands, *Hollenberg 3165*, Mar. 1941.

SYMPLOCA MURALIS Kütz. ex Gom. ibid. 16: 112. 1892. *S. muralis* var. *minor* Gardn. Univ. Calif. Publ. Bot. 14: 6. 1927. *S. symbiotica* Gardn.[2] Mem. N. Y. Bot. Gard. 7: 48. 1927. *Phormidium rubriterricola* Gardn.[2] ibid. 7: 43. 1927.—On soil often wet with fresh water. One specimen, CALIFORNIA: Riverside county: on soil in a pot in United States Department of Agriculture greenhouse, Riverside, *Hollenberg 2516*, Feb. 1939.

SYMPLOCA THERMALIS (Kütz.) Gom. ibid. 16: 114. 1892.—On wet rocks and woodwork in and about hot springs. One specimen, CALIFORNIA: Inyo county: outlet of swimming pool, Keough hot springs, *Groesbeck 390*, July 1941.

LYNGBYA AESTUARII (Mert.) Liebm. ex Gom. Ann. Sci. Nat. VII Bot. 16: 127. 1892. *L. ocreata* Gardn. Mem. N. Y. Bot. Gard. 7:

[1] The isotype of *Lyngbya magnifica* in the Herbarium of the University of California (PUERTO RICO: in a water reservoir, Rio Piedras, *Wille 105*, Dec. 1914) is excellent material of *Plectonema Wollei*.

[2] Isotypes of *Symploca symbiotica* (PUERTO RICO: Fort San Cristobal, San Juan, *Wille 2021b*) and *Phormidium rubriterricola* (PUERTO RICO: on red earth, Maricao, *Wille 1057*, Feb. 1915) in the Herbarium of the University of California are characteristic masses of *Symploca muralis*.

39. 1927. *L. scytonematoides* Gardn. loc. cit. 1927.—In fresh and brackish water and on soil. Specimens seen, CALIFORNIA: Modoc county: on mud beside the north fork of Pit river, Alturas, *Drouet & Richards 4174, 4175,* Sept. 1941. Inyo county: floating in Little lake, *Groesbeck 152, 153, 386,* Sept. 1940, July 1941; in a cold stream 1 foot from the outlet of Keough hot springs, *Groesbeck* 230, Nov. 1940. San Bernardino county: floating in a shallow reservoir, Old Woman springs, *Hollenberg 2082b,* May 1937. Imperial county: in a ditch in an open field at the south edge of Brawley, *Drouet & Macbride 4776,* Oct. 1941; in very shallow water in a salt marsh beside Carrizo creek west of Calexico, *Drouet & Macbride 4803, 4804,* Oct. 1941.

LYNGBYA VERSICOLOR (Wartm.) Gom. ibid. 16: 147. 1892. *Leptothrix tenax* Wolle F. W. Alg. U. S. 319. 1887. *Hypheothrix tenax* Wolle ex Forti Syll. Myxophyc. 329. 1907. *L. erecta* Gardn.[1] Mem. N. Y. Bot. Gard. 7: 38. 1927 (not Setch. & Gardn.). *Phormidium mucosum* Gardn.[1] ibid. 7: 43. 1927.—One specimen, from fresh water, CALIFORNIA: Mono county: on grass-stems in a cold pool at the travertine quarry near Bridgeport, *Groesbeck 273a,* Nov. 1940.

LYNGBYA OCHRACEA (Kütz.) Thur. ex Gom. ibid. 16: 149. 1892. *Leptothrix ochracea* Kütz. Phyc. gen. 198. 1843.—In pools of seepage-water. Specimens seen, CALIFORNIA: Modoc county: in a springy place beside the north fork of Pit river, Alturas, *Drouet & Richards 4183,* Sept. 1941. Riverside county: beside the stream in the lower part of Palm canyon near Palm Springs, *Drouet & Macbride 4732,* Oct. 1941.

PHORMIDIUM GROESBECKIANUM Drouet Field Mus. Bot. Ser. 20: 137, f. 7. 1942.—Among other algae in hot springs. One specimen, the type, NEVADA: Washoe county: Steamboat, *Groesbeck 195a,* Sept. 1940.

PHORMIDIUM LAMINOSUM Gom. ibid. 16: 167. 1892.—Forming the conspicuous algal masses, mainly as gelatinous strata, in many of the hot springs of the region. It is found here in water of all temperatures up to about 160° F. Many strains differing in diameter of trichome are encountered in the various groups of springs, and often in the same spring. In very hot water, and in some places in cooler water, the trichomes break up into hormogonia each of one or two protoplasts which individually simulate those of certain anacy-

[1] The isotypes of *Lyngbya erecta* Gardn. (PUERTO RICO: on stones in a brook in the vicinity of San Lorenzo, *Wille 501a,* Jan. 1915) and *Phormidium mucosum* (PUERTO RICO: in a basin in a garden in Humacao, *Wille 641,* Jan. 1915) are typical masses of *Lyngbya versicolor.*

stoid Chroococcaceae. As in species of Anacystis, the diameter of these protoplasts (hormogonia here) may become greater or less; and if such hormogonia subsequently grow in length, the resulting long trichomes retain the diameters assumed by the hormogonia. Specimens seen, including that reported by Inman in Journ. Gen. Physiol. 23: 665 (1940), NEVADA: Eureka county: in a hot spring, Beowawe, *O. L. Inman*, July 1939. Washoe county: in hot pools and springs, Steamboat, *Groesbeck 24, 113, 115, 279–281, 287, 288, 290, 358, 363, 364, 366, 426, 431, 432, 434, 438, 444,* 1940–41. CALIFORNIA: Modoc county: in Hot Springs, southwestern part of county, *Hall & Babcock*, June 1903. Sierra county: in Campbells hot springs, *Hall & Babcock*, June 1903. Mono county: in hot springs and pools at the travertine quarry near Bridgeport, *Groesbeck 30, 33, 34, 48, 91, 93, 98, 102, 157, 159, 164, 165, 173, 177, 180, 235, 236, 238, 239, 241, 243, 263, 267, 270, 323, 325, 327, 334, 340, 346, 347, 457, 459, 482,* 1940–41; Fales hot springs, *Groesbeck 26a, 104, 181, 187, 275, 276, 353, 354, 452–454,* 1940–41; in Hot creek and geysers, *Groesbeck 201, 204, 209, 210, 212, 402, 404, 405, 407, 408a, 416, 419, 421,* 1940–41; in and about a very hot artesian well on the north shore of Mono lake, *Groesbeck 130, 131,* Sept. 1940. San Bernardino county: Waterman hot springs, *Setchell 1580, 1581, 1583,* Dec. 1896; Arrowhead hot springs, *Parks 3243,* Dec. 1929, *Gardner 6, 14, 16, 19, 41,* May 1930.

PHORMIDIUM TRELEASEI Gom. Bull. Soc. Bot. Fr. 46: 37. 1899.—In waters of various temperatures (chiefly 100–160° F.) in hot springs in the region. It may be confused easily with the more tenuous strains of *P. laminosum* and *P. tenue*. Specimens seen, including those reported by Inman in Journ. Gen. Physiol. 23: 665 (1940), NEVADA: Eureka county: in a hot spring, Beowawe, *O. L. Inman*, July 1939. Washoe county: in hot springs, Steamboat, *Groesbeck 23, 112, 193, 197, 282, 374, 427, 439, 442,* 1940–41. CALIFORNIA: Modoc county: Hot Springs, southwestern part of county, *Hall & Babcock*, June 1903. Mono county: in hot springs and streams at the travertine quarry near Bridgeport, *Groesbeck 31, 35, 36, 160, 246, 255,* Apr.–Nov. 1940; in a small hot spring at Hot creek about 2 miles south of Whitmore Tub springs, *Groesbeck 60,* June 1940; in a small pool in rocks, Hot creek and geysers, *Groesbeck 203,* Nov. 1940. Inyo county: in the largest hot spring, Keough hot springs, *Groesbeck 396,* July 1941.

PHORMIDIUM TENUE (Menegh.) Gom. Ann. Sci. Nat. VII Bot. 16: 169. 1892.—In fresh water; commonly found in many hot springs

in the region in water with temperatures up to 140° F. Masses of unicellular and bicellular hormogonia of this species, similar to those described under *P. laminosum* above, are present in certain springs. Specimens seen, NEVADA: Washoe county: in the hot springs, Steamboat, *Groesbeck 111, 277, 357, 369, 430, 445, 449,* 1940–41. CALIFORNIA: Mono county: in hot springs and streams in the travertine quarry near Bridgeport, *Groesbeck 45, 89, 97, 156, 163, 170, 176, 178, 244, 245, 253, 262, 324, 328, 337, 345, 460, 466, 468, 478, 479,* 1940–41; at the vent, Casa Diablo geyser, *Groesbeck 322,* Apr. 1941; scrapings from steps at a large cold spring, Fales hot springs, *Groesbeck 184,* Sept. 1940. Inyo county: in pools, streams, and springs, Keough hot springs, *Groesbeck 66–68, 71, 143–146, 148–148b, 226–228, 232, 233, 309–312, 314–317, 389, 391–393, 395, 397, 398,* 1940–41; on the standpipe at Furnace creek ranch, Death valley, *Grinnell 7624,* Oct. 1933; in Benton hot springs, *Mrs. Partz,* Aug. 1866, *Duran 7794,* Apr. 1935; hot pool and spring, the Geysers, *Groesbeck 134, 142,* Sept. 1940. San Bernardino county: hot springs, San Bernardino mountains, *Parish,* June 1891 (D, F); Arrowhead hot springs, *Gardner 8, 23, 44, 45,* May 1930.

PHORMIDIUM VALDERIANUM Gom. ibid. 16: 167. 1892.—In fresh water. Specimens seen, CALIFORNIA: Imperial county: pool at the carbon-dioxide wells, south end of Salton sea, *Groesbeck 53, 54,* Jan. 1940.

PHORMIDIUM RETZII (Ag.) Gom. ibid. 16: 175. 1892. *P. leptodermum* var. *capitatum* Gardn. Mem. N. Y. Bot. Gard. 7: 43. 1927.—In fresh water. Specimens seen, CALIFORNIA: Modoc county: in shallow water in the sloughs along the north fork of Pit river, Alturas, *Drouet & Richards 4161,* Sept. 1941. San Bernardino county: in seepage on the wall of an artificial reservoir north of Redlands, *Hollemberg 3060,* Dec. 1939.

PHORMIDIUM SUBFUSCUM Gom. ibid. 16: 184. 1892.—In flowing fresh water. One specimen, CALIFORNIA: San Bernardino county: on rock in trickle from spillway emptying into an artificial reservoir north of Redlands, *Hollemberg 3059,* Dec. 1939.

PHORMIDIUM UNCINATUM (Ag.) Gom. ibid. 16: 184. 1892.—In fresh water. Specimens seen, CALIFORNIA: Modoc county: in sloughs, swales, and drains beside the north fork of Pit river, Alturas, *Drouet & Richards 4133, 4139, 4141, 4149,* Sept. 1941. Inyo county: on plant stems, pool in stream flowing from Monument headquarters to the playa in the bottom of Death valley, *Groesbeck 9,* Feb. 1940. San Bernardino county: scum in a water-vessel near Redlands,

Hollenberg 3162, Feb. 1941. Riverside county: on rocks in swift water below the falls in Tahquitz canyon near Palm Springs, *Drouet & Macbride 4744*, Oct. 1941.

OSCILLATORIA PRINCEPS Vauch. ex Gom. ibid. 16: 206. 1892. *O. princeps* f. *purpurea* Coll. in Coll. Hold. & Setch. Phyc. Bor.-amer. 16: 753. 1900. *O. obtusa* Gardn. Mem. N. Y. Bot. Gard. 7: 38. 1927. *Lyngbya gigantea* Lew. Zirk. & Patr. Journ. Mitch. Sci. Soc. 1933: 221. 1933.—In fresh water, and in hot water with temperatures up to (in these collections) 120° F. Specimens seen, CALIFORNIA: Mono county: in creek, pools, and hot springs, Hot creek and geysers, *Groesbeck 205, 207, 208, 413, 414*, Nov. 1940, July 1941. San Bernardino county: Arrowhead hot springs, *Gardner 11*, May 1930.

OSCILLATORIA SANCTA Kütz. ex Gom. ibid. 16: 209. 1892.—Submersed and subaerial in fresh water. Specimens seen, CALIFORNIA: San Bernardino county: Arrowhead hot springs, *Gardner 4, 10*, May 1930.

OSCILLATORIA TENUIS Ag. ex Gom. ibid. 16: 220. 1892. *O. americana* Kütz. ex Gom. (as sp. inquir.) ibid. 16: 236. 1892; Kütz.[1] Tab. Phyc. 1: 28. 1847.—In fresh water. Specimens seen, CALIFORNIA: Modoc county: in pools and sloughs along the north fork of Pit river, Alturas, *Drouet & Richards 4138, 4142, 4151, 4156*, Sept. 1941. Mono county: in the outlet of a spring on the east shore of Mono lake, *Groesbeck 127*, Sept. 1940. Inyo county: floating in Little lake, *Groesbeck 384*, July 1941; near Borax lake, Death valley, *Wilkenson*, June 1910; with *Phormidium uncinatum* on plant stems, pool in stream flowing from Monument headquarters to a playa in the bottom of Death valley, *Groesbeck 9*, Feb. 1940. San Bernardino county: in a temporary pool, Redlands, *Hollemberg 3097*, Apr. 1940. Riverside county: in shallow water of Colorado river 10 miles south of Vidal, *Drouet & Macbride 4645, 4647*, Oct. 1941. Imperial county: in a freshwater stream by Salton sea between Pope and Frink stations, *Drouet & Macbride 4759*, Oct. 1941.

OSCILLATORIA CHLORINA Kütz. ex Gom. ibid. 16: 223. 1892.—In fresh water. This species is represented sparingly in one collection, CALIFORNIA: San Bernardino county: with *O. amphibia* floating in upper "multiple lakes" in San Timoteo canyon near Redlands, *Hollenberg 3080*, Feb. 1940.

[1] Material labeled "Oscillaria americana Kütz. Antillen. ex herb. Kützing" and presumably collected by R. Schomburgk, in the Herbarium of the University of California is easily recognizable as *O. tenuis*.

OSCILLATORIA AMPHIBIA Ag. ex Gom. ibid. 16: 221. 1892.—In brackish and fresh water. One collection, CALIFORNIA: San Bernardino county: floating in upper "multiple lakes" in San Timoteo canyon near Redlands, *Hollenberg 3080*, Feb. 1940.

OSCILLATORIA SPLENDIDA Grev. ex Gom. ibid. 16: 224. 1892. *O. splendida* f. *uncinata* Setch. & Gardn.[1] Univ. Calif. Publ. Bot. 1: 184. 1903.—In fresh water. One specimen, CALIFORNIA: Modoc county: with *Cylindrospermum licheniforme* on the shore of the north fork of Pit river, Alturas, *Drouet & Richards 4179*, Sept. 1941.

OSCILLATORIA AMOENA (Kütz.) Gom. ibid. 16: 225. 1892.—In fresh water. Specimens seen, NEVADA: in a small basin, Steamboat hot springs, *Groesbeck 114a*, June 1940. CALIFORNIA: Mono county: in a cold pool in the travertine quarry near Bridgeport, *Groesbeck 39*, Apr. 1940.

OSCILLATORIA FORMOSA Bory ex Gom. ibid. 16: 230. 1892.—In fresh water. One specimen, CALIFORNIA: floating in the travertine quarry near Bridgeport, *Groesbeck 266*, Nov. 1940.

OSCILLATORIA CHALYBEA Mert. ex Gom. ibid. 16: 232. 1892. *O. trapezoidea* Tild. Bull. Torr. Club 23: 58. 1896.—In fresh and brackish water. Specimens seen, including that reported by Hutchinson in Trans. Conn. Acad. Sci. 33: 83 (1937), NEVADA: Churchill county: with *Spirulina subsalsa*, margin of Big Soda lake near Fallon, *Hutchinson*, July 1933 (D). CALIFORNIA: Mono county: in a warm spring, east shore of Mono lake, *Groesbeck 126*, Sept. 1940; in warm springs in the travertine quarry near Bridgeport, *Groesbeck 99*, *474*, 1940–41. Inyo county: in a tepid spring in Furnace creek wash, Death valley, *Groesbeck 296*, Jan. 1941. San Bernardino county: in a hot creek in a canyon, Arrowhead springs, *Parks 3245b*, Dec. 1929; with *O. amphibia* floating in upper "multiple lakes" in San Timoteo canyon near Redlands, *Hollenberg 3080*, Feb. 1940.

OSCILLATORIA BREVIS Kütz. ex Gom. ibid. 16: 229. 1892.—Chiefly on mud, less often seen in shallow water. Specimens seen, CALIFORNIA: Modoc county: in the drain from the ice-factory, Alturas, *Drouet & Richards 4141*, Sept. 1941. Mono county: in a small cold pool, Hot creek geysers, *Groesbeck 412*, July 1941. Riverside county: with *Symploca muralis* on soil in a pot in the United States Depart-

[1] *O. splendida* f. *uncinata* as represented by the TYPE (WASHINGTON: Whidbey island, *Setchell & Gardner 574*, July 1901) in the Herbarium of the University of California appears to me not to deserve formal distinction among the many strains and growth-forms of *O. splendida*.

ment of Agriculture greenhouse, Riverside, *Hollenberg 2516*, Feb. 1939.

OSCILLATORIA BORYANA Bory ex Gom. ibid. 16: 234. 1892.—In hot springs. Specimens seen, NEVADA: Washoe county: in hot springs, Steamboat, *Groesbeck 195, 198*, Sept. 1940. CALIFORNIA: Mono county: in a pool, Hot creek geysers, *Groesbeck 403, 408*, July 1941.

OSCILLATORIA TEREBRIFORMIS Ag. ex Gom. ibid. 16: 234. 1892.—In hot springs. Specimens seen, CALIFORNIA: Mono county: in a pool and on wet earth, Hot creek and geysers, *Groesbeck 200, 401*, 1940–41; in a water-trough in the travertine quarry near Bridgeport, *Groesbeck 247, 329*, 1940–41. San Bernardino county: Harlem hot springs, *Setchell 1559*, Dec. 1896; Arrowhead hot springs, *Gardner 1, 2, 7, 9*, May 1930.

SPIRULINA MAJOR Kütz. ex Gom. ibid. 16: 251. 1892. *S. densa* Lill. Amer. Mid. Nat. 16: 210. 1935.—In shallow fresh and brackish water. Found sparingly in one specimen, CALIFORNIA: San Bernardino county: with *Oscillatoria amphibia* floating in upper "multiple lakes" in San Timoteo canyon near Redlands, *Hollenberg 3080*, Feb. 1940.

SPIRULINA SUBSALSA Oerst. ex Gom. ibid. 16: 253. 1892. *Arthrospira subsalsa* Crow apud Croasd. F. W. Alg. Woods Hole, Mass. 18. 1935.—In brackish and salt water. One specimen, reported by Hutchinson in Trans. Conn. Acad. Sci. 33: 83 (1937), NEVADA: Churchill county: margin of Big Soda lake near Fallon, *G. E. Hutchinson*, July 1933 (D).

SPIRULINA LABYRINTHIFORMIS (Menegh.) Gom. ibid. 16: 255. 1892.—In warm water in and about hot springs. Specimens seen, NEVADA: Washoe county: in a small basin in a calcareous deposit, Steamboat springs, *Groesbeck 114a*, June 1940. CALIFORNIA: Mono county: in a cold pool, Hot creek geysers, *Groesbeck 417*, July 1941; in warm and cold pools in the travertine quarry near Bridgeport, *Groesbeck 44, 161, 166, 167, 273, 332, 461*, 1940–41.

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